

AMENDMENTS TO THE DRAWINGS/FIGURES

Replacement Sheets 1/5-5/5 are attached. The attached Replacement Sheets, which include Figs. 1-5, replace the original sheets including Figs. 1-5.

REMARKS

The applicants appreciate the Examiner's thorough examination of the application and requests reexamination and reconsideration of the application in view of the following remarks.

The Examiner has objected to the informal drawings. Accordingly, applicants herein submit five (5) replacement drawing sheets to provide formal drawings for the subject application.

The Examiner objects to the Specification in paragraph 2 of the Office Action because the Specification allegedly does not teach the features of “scaling the accumulated fractional phase by a predetermined frequency value; and loading the predetermined frequency value into an interpolator...”. These features were originally claimed in claim 13 of the subject application. However, applicants herein amend claim 13 to change the term “frequency” to “phase”, thereby traversing this objection. Support for this amendment to claim 13 can be found at page 5, lines 16-21 of the subject application.

The Examiner objects to claims 1, 2, 6, and 13 due to alleged informalities. Applicants herein amend these claims and adopt the Examiner’s suggestions. Applicants respectfully request that the Examiner withdraw the objections to these claims.

Claims 1-7, 12 and 14 stand rejected under 35 U.S.C. 112, first paragraph, as allegedly failing to comply with the enablement requirement. To correct typographical errors, applicants herein amend independent claims 1, 7, and 12, the specification and abstract to recite that the interpolator is responsive to F and M, rather than the input fraction F/M. Support for this amendment can be found in Figs. 2, 4, and 5 and accompanying description. Applicants also herein amend claim 14 to recite “selectively applying the fractional value”. Support for this amendment can be found at page 13, lines 19-23. Accordingly, applicants respectfully request

that the Examiner withdraw the rejection of claims 1-7, 12, and 14 under 35 U.S.C. 112, first paragraph.

The Examiner indicates that claims 8-11 are allowed. Applicants would like to thank the Examiner for the indication of allowable subject material.

Claim 13 stands rejected under 35 U.S.C. 102(b) as allegedly being anticipated by U.S. Patent No. 6,353,649 to *Bockleman et al.*

Bockleman et al. relates to a direct digital synthesizer. *Bockleman et al.* fails to disclose, however, applicants' claimed fractional-N synthesizer as recited in claim 13.

In a typical fractional-N synthesizer, the divider in the feedback path has an integer and fractional part and the output frequency step resolution is a fraction of the reference frequency, as shown in equation 1:

$$f_{OUT} = \left(N + \frac{F}{M}\right) \times f_{REF} \quad (1)$$

The fractional part is generated using a digital interpolator. This outputs a sequence of integer values with an average value given by F/M where F is the input fraction and M is the modulus. See the subject application at page 2, line 25 to page 3, line 7.

Bockleman et al. does not disclose such a fractional-N synthesizer in which the divider in the feedback path includes an integer and a fractional part. Rather, *Bockleman et al.* discloses a synthesizer in which the output frequency of the synthesizer 200 shown in Fig. 2 is $f_{OUT} = f_{REF} \left(\frac{N}{C}\right)$. See Column 2, lines 31-35 of *Bockleman et al.* Accordingly, applicants respectfully request that the Examiner withdraw the rejection of claim 13 under 35 U.S.C. 102(b).

Claim 15 stands rejected under 35 U.S.C. 102(e) as allegedly being anticipated by U.S. Patent No. 6,556,086 B2 to *Keaveney et al.* Applicants herein amend claim 15 to recite that the

phase of the output signal is varied with respect to the phase of said input reference signal.

Applicants make this amendment to expedite prosecution, and not for reasons related to patentability since this feature was already apparent from the claim language.

The subject invention results from the realization that a truly simple and effective fractional-N synthesizer with programmable output phase can be achieved by generating synchronization pulses at integer multiples of periods of the input reference signal and re-initializing the interpolator with a synchronization pulse to define the phase of the output signal or resetting the interpolator with a predetermined phase adjustment value to vary the phase of the output signal with respect to the phase of the input signal.

Prior fractional-N synthesizers have been designed to synchronize the phase output signal with the input reference signal. For example, the fractional-N synthesizer of *Keaveney et al.* generates a synchronization pulse at integer multiples of periods of the input reference signal and gates one of those synchronization pulses to re-initialize the interpolator of the fractional-N synthesizer in order to synchronize the phase of the output signal with the input reference signal. The design of the *Keaveney et al.* produces an output signal with a resultant phase which is phase locked to the input reference signal for channels at the same frequency. One drawback of the design of *Keaveney et al.* is that it cannot be programmed to vary phase of the output signal with respect to the phase of the input reference signal as claimed by applicants. Varying the output frequency in a fractional-N synthesizer is useful in applications such as wireless systems (e.g., cellular phones) where two or more channels at the same frequency need to have different phases to reduce interference. Other possible applications of a fractional-N synthesizer with programmable output phase include phased radar systems wherein RF waves are transmitted at the same frequency but at different phases to form constructive and destructive interference, e.g.,

beam forming, where the beam needs to be focused on objects in the sky. Other beam forming applications of a fractional-N synthesizer with programmable output phase may include focusing RF waves of broadcasting/ transmitting stations located on the coast only in the direction of the proximate land. See the subject application at page 4, line 10 to page 5, line 6.

Accordingly, claim 15 is patentable over *Keaveney et al.* Applicants respectfully request that the Examiner withdraw the rejection of claim 15 under 35 U.S.C. 102(e).

CONCLUSION

Each of the Examiner's rejections has been addressed or traversed. It is respectfully submitted that the application is in condition for allowance. Early and favorable action is respectfully requested.

If for any reason this Response is found to be incomplete, or if at any time it appears that a telephone conference with counsel would help advance prosecution, please telephone the undersigned or his associates, collect in Waltham, Massachusetts at (781) 890-5678.

Respectfully submitted,



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DWP/ok